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10/582,330

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Hitoshi Sumiya

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MCDERMOTT WILL & EMERY LLP
600 13TH STREET, N.W.
WASHINGTON, DC 20005-3096

EXAMINER

HAN, SHENG

ART UNIT

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1793

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|--------------------------------------|--|--|
| Office Action Summary | Application No. 10/582,330 | Applicant(s) SUMIYA, HITOSHI | |
| | Examiner SHENG HAN | Art Unit 1793 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 and 12-16 is/are pending in the application.
4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-5 and 12-16 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>2/12/09</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION***Response to Arguments***

Applicant has amended Claim 1 to include the limitation that "boron is included in a lattice site of said particle of said diamond" which is fully encompassed by the reference used in Examiner's previous rejection. Specifically, Swain teaches that boron is added to the nanocrystalline diamond structure (abstract) where the boron is added to the crystals as opposed to grain boundaries between the crystals (para. 0011). This is further explained by Swain in paragraph 0071, where he distinguishes between these phases. Swain explains that in general, boron atoms in the gas phase are incorporated into a diamond in two places: in the grain boundaries as well as inserted into the growth of the diamond lattice (para. 0071). The phase of boron used by Swain in his invention is a gaseous mixture of boron (para. 0014). Therefore, Applicant's assertion that Swain does not teach the boron concentration within the diamond particle is wrong. Although Swain discusses the concentration of B₂H₆, it also explains that the boron concentration is in the diamond lattice.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starchenko (WO 03/086971) and further in view of Swain (2005/0110024).

Starchenko teaches the synthesis of a superhard diamond material using boron (preferred process and abstract), for use in tools. The reference does not, however, specify how much boron is used.

Swain teaches a boron-doped nanocrystalline diamond (title, abstract). The diamond particles are disclosed to be between 10-16nm in size and the boron concentration is between 1 to 20ppm (para. 0034 and 0071). Although Swain does not specifically teach that the average particle size is below 50nm, however, it is inherent that since the particle range is all below 50nm, that the average particle size would be below 50nm. Moreover, it would have been obvious to one of ordinary skill in the art at the time of the invention to put from 1-100 ppm of boron in the diamond composition, as taught by Swain, with the diamond particles for use in tools, as taught by Starchenko because boron enables diamonds to be electrically conductive, which would make it more effective in certain tools.

Regarding Claim 2, Swain teaches an electrical resistance of 0.2 ohm cm (para. 0031). This is less than 10 ohm cm.

Regarding Claim 3, since Swain teaches a particle range of between 10-16nm (para. 0034), the maximum particle range is less than 50nm and the average particle diameter is less than 30nm.

Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starchenko (WO 03/086971) in view of Swain (2005/0110024) as applied to Claim 1, and further in view of Akaishi (WO2004/046062). Please see the corresponding US version (2006/0115408).

Starchenko and Swain teach diamonds with a specific particle range, boron composition and resistance, but neither of them teach a hardness level of over 80-110 GPa.

Akaishi teaches a high hardness diamond having a maximum size of 100nm or less (abstract). The diamond is conductive and therefore has a low resistivity (para. 0051). Regarding the hardness, Akaishi teaches that the hardness is over 80 GPa (para. 0048, 100 GPa) and over 110 GPa (para. 0050, 115 GPa).

It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the superhard diamond with a hardness of over 80 and

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110 GPa, as taught by Akaishi, for use in tools, such as drills because these tools require a high strength and resistance under a lot of pressure.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Meidensha (2001/21521).

Meidensha teaches a diamond with particle diameter of 1-10 micrometers (1,000-10,000 nm) (para. 0016) with a boron amount of 100,000ppm (para. 0025).

Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meidensha as applied to Claim 12, and further in view of Swain (2005/0110024).

Meidensha teaches a diamond particle with a diameter of 1-20 microns and a boron amount of 100,000ppm, but does not teach a particle size of less than 1,000nm.

Swain teaches a boron-doped nanocrystalline diamond (title, abstract). Swain further teaches that the resistance is 0.2 Ohm cm (para. 0031). Boron enhances conductivity which thereby decreases resistance. Therefore, although the amount of boron in the claim is more than the amount described in Swain, it would be inherent that the conductivity would be less than 0.2 ohm cm.

Regarding Claim 14, the diamond particles disclosed are between 10-16nm in size (para. 0034). Although Swain does not specifically teach that the

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average particle size is below 500nm, however, it is inherent that since the particle range is all below 50nm, that the average particle size would be below 500nm.

Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meidensha and Swain as applied to claims 12 and 13 above, and further in view of Akaishi.

Meidensha and Swain teach a diamond with a particle size of 10,000nm and 1,000nm with a boron composition of 100,000ppm and 1 to 20ppm (para. 0034).

Akaishi teaches a high hardness diamond having a maximum size of 100nm or less (abstract). The diamond is conductive and therefore has a low resistivity (para. 0051). Regarding the hardness, Akaishi teaches that the hardness is over 80 GPa (para. 0048, 100 GPa) and over 110 GPa (para. 0050, 115 GPa).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use a diamond with a hardness of over 80 and 110 GPa, as taught by Akaishi, with the diamond composition, as taught by Meidensha and Swain for use in tools, such as drills because these tools require a high strength and resistance under a lot of pressure.

Conclusion

1. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SHENG HAN whose telephone number is (571)270-5823. The examiner can normally be reached on Monday-Thursday, 8:00-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Melvin Curtis Mayes can be reached on 571-272-1234. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Sheng Han
Examiner
Art Unit 1793

SH
May 28, 2009

/Melvin Curtis Mayes/
Supervisory Patent Examiner, Art Unit 1793